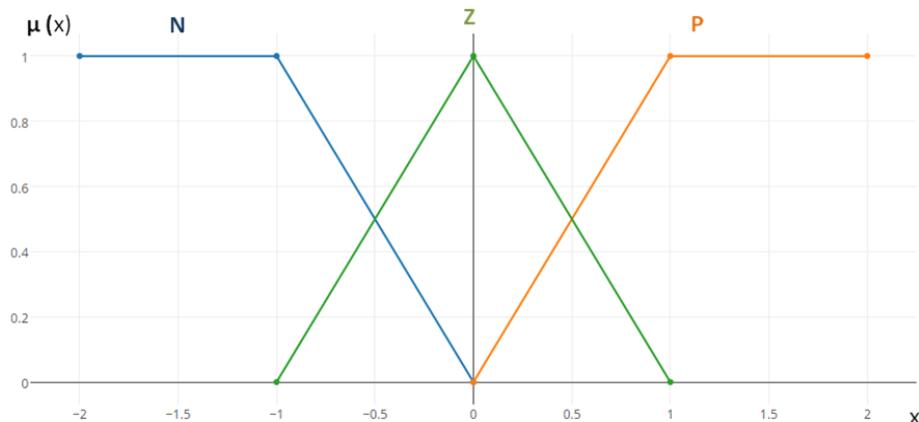


- 1- Explain the limitations of using conventional controllers.
- 2- What are the advantages of fuzzy controllers?
- 3- Explain with example the main difference between a binary set and a fuzzy set.
- 4- What is meant by the universe of discourse of fuzzy set?
- 5- Draw a membership function that:
  - a) quantifies the set of all people of medium height.
  - b) quantifies the set of all short people.
  - c) quantifies the set of all tall people.
  - d) quantifies the statement “the number  $x$  is near 10.”
  - e) quantifies the statement “the number  $x$  is less than 10.”
  - f) quantifies the statement “the number  $x$  is greater than 10.”
  - g) Repeat (d)–(f) for  $-5$  rather than 10.
- 6- For the following MFs:



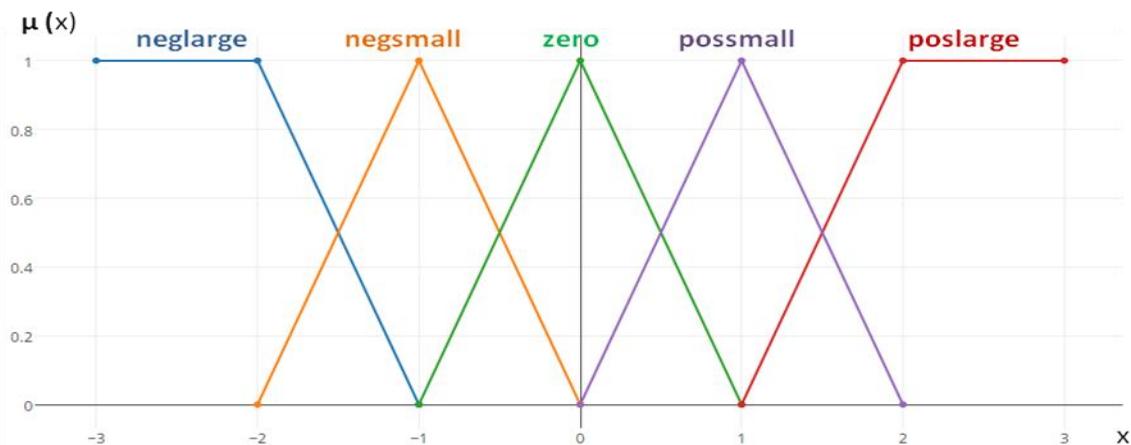
- a) Find the MF degree ( $\mu$ ) for the fuzzy sets N, Z and P for:  
 $x = -0.25 \text{ & } x = 0.25 \text{ & } x = -0.1 \text{ & } x = 0.1 \text{ & } x = -0.5 \text{ & } x = 0.5$
- b) Find the support and core for the fuzzy sets N, Z and P.

7- Consider two fuzzy sets:

**Long pencils** = {pencil1 / 0.1, pencil2 / 0.2, pencil3 / 0.4, pencil4 / 0.6, pencil5 / 0.8, pencil6 / 1}, **medium pencils** = {pencil1 / 1, pencil2 / 0.6, pencil3 / 0.4, pencil4 / 0.3, pencil5 / 0.1}.

- h) Determine the results of the union and the intersection of these fuzzy sets.
- i) Also, find the fuzzy set that represents "not long pencils and not medium pencils".

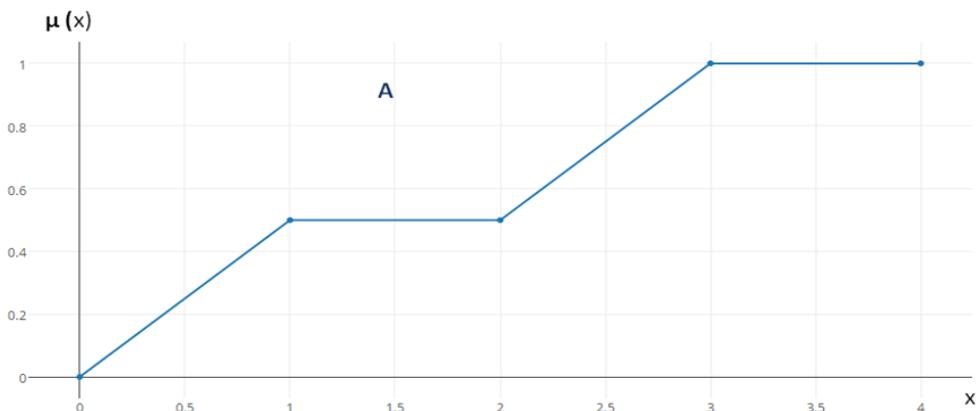
8- Consider the membership functions shown below. Sketch the membership function for the possibility “**error is zero and error is possmall**” using both the minimum and the product operations used for and logic. Also sketch the membership function for the possibility “**error is zero or error is possmall**” using both the maximum operation and the algebraic sum used for or logic.



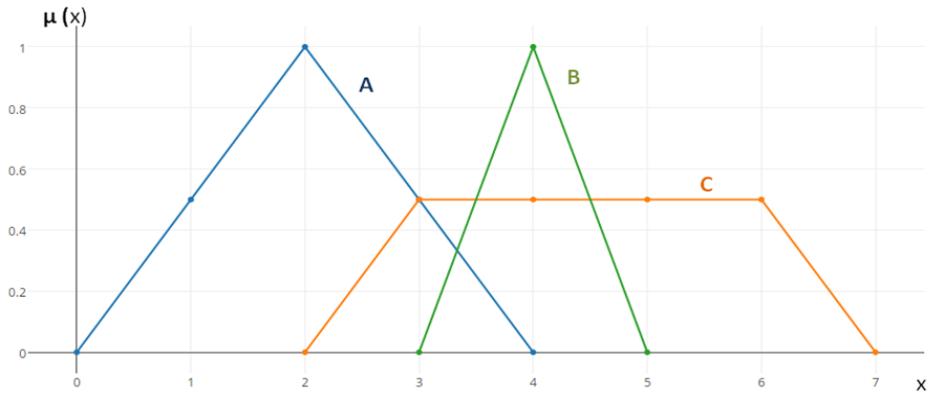
9- Choose one of the fuzzy controller's applications and explain in brief the role of the fuzzy controller in this application.

10- For the following fuzzy sets:

Draw  $A^c$



Draw:



- a)  $A \cup C$
- b)  $A \cap C$
- c)  $A \cup B$
- d)  $A \cap B$
- e)  $A \cup B \cup C$
- f)  $A \cap B \cap C$

11- State whether the fuzzy sets **A** and **B** are **convex** or **non convex**, **normal** or **subnormal**.

